

Tea Consumption and Risk of Bladder and Kidney Cancers in a Population-based Case-Control Study

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Recent epidemiologic studies have suggested that tea may be protective against cancers of the urinary tract. The authors examined the association between usual adult tea consumption and risk of bladder and kidney cancers in a population-based case-control study that included 1,452 bladder cancer cases, 406 kidney cancer cases, and 2,434 controls. For bladder cancer, the age- and sex-adjusted odds ratios (OR) (95% confidence intervals (CI)) referent to nonusers of tea were 0.9 (0.7, 1.1) for <1.0 cup/day, 1.0 (0.8, 1.2) for 1.0–2.6 cups/day, and 0.9 (0.7, 1.1) for >2.6 cups/day (cutpoints for users based on the tertile distribution among controls). When more extreme cutpoints were used, persons who consumed >5 cups/day (>90th percentile) had a suggestive decreased risk (OR = 0.7; 95% CI 0.5, 1.0), but there was no evidence of a dose-response relation. In analyses stratified by median total beverage intake (2.6 liters/day), there was an inverse association with tea use among persons who consumed less than the median (OR = 0.5; 95% CI 0.3, 0.8) but no association for persons who consumed at or above the median. In contrast, for kidney cancer, there was no association with tea use. Adjustment for site-specific risk factors did not alter these results. This study offers only minimal support for an inverse association between tea consumption and bladder or kidney cancer risk. *Am J Epidemiol* 2000;151:377–83.

bladder neoplasms; case-control studies; diet; kidney neoplasms; tea

Tea (*Camellia sinensis*) is a beverage commonly consumed throughout the world. Tea contains several polyphenolic components with antioxidant properties which have been found in a number of experimental tumor models (1–3) to exert a chemoprotective effect. However, most of these experimental studies used green tea extracts. Black tea, the type of tea consumed most often in Western countries, contains different profiles of polyphenols due to the process of fermentation, but it has also shown chemoprotective activity (3–5).

A number of cohort (6–8) and case-control (9–29) studies have examined the association between tea and cancers of the urinary tract. These epidemiologic studies have generally found no association for bladder cancer (7–24). One case-control study found a significant positive association for men (18), while one cohort and four case-control studies found nonsignificant inverse associations for women (6, 11, 12, 19, 21). The studies that have examined the association with kidney cancer are fewer and have also been inconsistent. One cohort and one case-control study reported a nonsignificant positive association (7, 28); four case-control studies found no association (9, 25, 26, 29); and two studies, one cohort and one case-control study, found inverse associations among women (6, 27). The potential limitations of previous studies include hospital-based case-control designs (9–13, 16, 17, 22–24, 26, 29), limited exposure assessment (19, 22, 25), and simultaneous evaluation of multiple exposures and/or multiple cancer sites (6–9, 11–13, 15–17, 19, 21, 22, 25), possibly introducing a multiple comparisons problem. In a recent prospective cohort study of older Iowa women, Zheng et al. (6) found evidence of an inverse association between tea consumption and both kidney and bladder cancers. We attempted to replicate and extend these findings using a population-based case-control study in another Iowa population.

Received for publication November 18, 1998, and accepted for publication May 12, 1999.

Abbreviations: CI, confidence interval; EGCG, (–)-epigallocatechin-gallate; OR, odds ratio; SEER, Surveillance, Epidemiology, and End Results Program.

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MATERIALS AND METHODS

This population-based case-control study was conducted between 1986 and 1989 to investigate cancer risk and drinking water contaminants. Full details on methods have been published elsewhere (30). Briefly, eligible cases of bladder and kidney cancer were identified through the Iowa Cancer Registry, which is part of the National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) Program (31). This program was supplemented by a rapid reporting system during 1987 and 1989. Eligible cases were residents of Iowa, ages 40–85 years, with histologically confirmed bladder or kidney cancer and no previous diagnosis of a malignant neoplasm (excluding basal and squamous cell carcinomas of the skin). Cases of both in situ and invasive bladder cancer (transitional cell carcinoma and papillary transitional cell carcinoma) were included because they appear to share the same risk factors (32). Kidney cancers were adenocarcinomas with exclusion of cancers of the renal pelvis. The accrual of bladder cancer cases occurred in two phases. In the first phase, from 1986 to 1987, bladder cancer cases were obtained as part of a six cancer site case-control study. In the second phase, from 1988 to 1989, only bladder cancer cases were added to the study. Kidney cancer cases were obtained during the first phase from 1986 to 1987.

A single control series was used in the analyses of both cancer sites. Cases from all six cancer sites were frequency-matched to controls by sex and 5-year age group, with a case-control matching ratio of approximately 2.3:1. The additional bladder cancer cases from the second phase of case collection were also frequency matched to controls with a case-control matching ratio of 1:1. Controls under age 65 years were selected from the state of Iowa drivers' license records, while those aged 65 years and older were selected from US Health Care Financing Administration records. Both sources afford excellent coverage of the state population (33, 34).

After obtaining physician consent for cases, a letter was sent to each case or next-of-kin explaining the purpose of the study. This was followed by a telephone call to invite participation by completing a mailed questionnaire. The mailed questionnaire included demographic information, occupational history, smoking history, familial history of cancer in first-degree relatives, as well as past medical conditions. A 55-item food frequency questionnaire was also included as well as items about adult fluid consumption. Specific questions were asked about the usual adult consumption of iced tea and hot tea (including herbal teas) as well as coffee and other beverages inside and outside of the home. Total beverage consumption (liters/day) was estimated

from usual adult fluid consumption of drinking water, coffee, tea, fruit juices/drinks, soups, milk, soft drinks, and alcoholic beverages. Non-drinking water items (i.e., milk, soft drinks, and alcoholic beverages) accounted for less than 30 percent of the variability in total beverage consumption, so participants with missing values on one of these items were assigned values imputed from the median value by sex and case/control status; this is in contrast to the previous report by Cantor et al. (30), where any missing value in the individual items made the total beverage variable missing.

Subjects who were reluctant to complete the detailed questionnaire (5.8 percent) were offered a 15-minute abbreviated telephone interview. This interview excluded the detailed occupational history and food frequency questionnaire, but did obtain information on beverage (including tea) consumption, smoking, and other information considered essential for the original analysis of water quality and cancer risk.

During the study period, 1,716 bladder cancer cases were identified, of whom 1,452 completed the questionnaire for an 84.6 percent response rate. For kidney cancer, 463 cases were identified, of whom 406 responded for an 87.7 percent response rate. The percent of proxy respondents was 10.8 percent for bladder cancer cases and 20.4 percent for kidney cancer cases. A total of 2,434 controls completed the questionnaire for an 80.3 percent response rate with 1.4 percent proxy response.

The a priori hypothesis was that all tea (hot tea and iced tea combined) would be protective since we expected no differences in the polyphenol content. However, we evaluated hot tea and iced tea separately and found no material differences; we therefore present results for hot and iced tea combined. Unconditional logistic regression analysis was used to estimate the odds ratios and corresponding 95 percent confidence intervals. Prior to analysis, tea use (cups/day) was categorized as none, low (<1 cup/day), medium (1–2.6 cups/day), and high (>2.6 cups/day), with cutpoints for users based on the tertile distribution of use among controls. In post-hoc analyses to evaluate risk associated with higher levels of tea use, we also used cutpoints at the 70th (3 cups/day) and the 90th (5 cups/day) percentiles of use among the controls.

All odds ratios were adjusted for age, education (less than high school, high school, greater than high school), smoking status (never, former, current), and pack-years of cigarette smoking (continuous). Bladder cancer was further adjusted for site-specific risk factors including an index of a priori high risk occupations, family history of bladder cancer, total beverage consumption, lifetime chlorinated surface water exposure, vegetable intake, and coffee consumption.

Kidney cancer was also adjusted for site-specific risk factors including family history of kidney cancer, hypertension, body mass index, and consumption of fruits, vegetables, meats, fats, and coffee. A trend test for a dose-response relation across levels of tea use was performed by treating each ordinal score variable (with values of 0, 1, 2, and 3) as a continuous variable in the logistic regression after adjustment for potential confounders.

We also evaluated the possible modifying effects of sex, smoking (ever, former, current), years of drinking chlorinated surface water (<20 years, ≥20 years), coffee consumption (no, yes), and total beverage consumption (median split) on the risk of both bladder and kidney cancer. There were no striking sex differences, so the combined results are reported, although we do report the results for women using cutpoints similar to those of the Iowa Women's Health Study (6) to facilitate comparison. The other factors were evaluated either because they had previously been suggested to modify bladder cancer risk (i.e., smoking (14, 30) and total beverage consumption (35)) or because of their potential for strong confounding (i.e., coffee intake and years of drinking chlorinated surface water).

RESULTS

When use of hot and iced tea was combined, 43 percent of men and 51 percent of women reported any tea use among the controls. Approximately equal numbers of men and women drank iced tea (36 percent), while women drank hot tea (32 percent) more commonly than men (21 percent). Among controls who drank tea, the median use of any tea was 2.0 cups/day; the respective medians for hot and iced tea use were 0.1 and 2.0 cups/day, and were similar for men and women. However, among tea users, there was no correlation between amount of hot and iced tea consumed (Pearson's $r = -0.03$).

Table 1 presents the distribution of tea consumption by selected demographic and potential confounding variables in the control group. Greater tea consumption was associated with female sex and greater total beverage consumption. There was little difference in the distribution of age, education, family history of cancer, history of hypertension, duration of chlorinated surface water exposure, and consumption of fruits, vegetables, fat, and meat across levels of tea use. There was an inverse association between coffee and tea use. The association between tea use and smoking was more complex. Among non-tea users and persons who consumed high levels of tea (>2.6 cups/day), 22.3 percent and 20.7 percent were current smokers, respectively. Among persons who consumed low (<1.0 cup/day) and intermediate (1.0–2.6 cups/day) levels of

TABLE 1. Relation of selected risk factors with level of tea consumption among the controls, Iowa, 1986–1989

	% distribution of tea consumption (cups/day)			
	None	<1	1–2.6	>2.6
Sex				
Male	69.4	67.4	58.9	60.4
Female	30.6	32.6	41.2	39.6
Age (years)				
<55	9.3	12.0	7.2	12.7
55–64	22.4	24.3	20.2	20.8
65–74	36.6	36.5	38.7	39.6
≥75	31.7	27.3	33.9	26.9
Education				
<High school	23.7	15.1	19.8	18.6
High school	51.8	46.7	51.6	53.9
>High school	24.5	38.3	28.6	27.5
Smoking				
Never	39.4	47.8	50.0	44.8
Former	38.3	34.9	36.5	34.4
Current	22.3	17.3	13.4	20.7
Hypertension				
Yes	34.7	39.2	37.5	38.0
No	65.3	60.8	62.5	62.0
Family history of kidney cancer				
Yes	1.3	3.1	1.3	0.3
No	98.7	96.9	98.7	99.7
Family history of bladder cancer				
Yes	1.5	0.6	1.6	1.2
No	98.5	99.4	98.4	98.8
Fruits (servings/week)				
<9.5	22.4	18.3	16.2	16.9
9.5–15.3	19.9	24.0	18.5	20.2
15.4–22.0	18.6	25.5	22.4	18.0
>22.0	18.6	17.1	22.0	25.8
No data*	20.6	15.3	21.0	19.1
Vegetables (servings/week)				
<17.9	22.7	16.8	15.7	19.1
17.9–24.1	20.8	23.7	19.7	13.6
24.2–32.0	19.1	24.3	20.2	19.9
>32.0	16.8	20.1	23.4	28.3
No data*	20.6	15.3	21.0	19.1
Fat (g/day)				
<45.6	18.7	19.2	23.9	22.2
45.6–62.8	18.7	24.3	18.7	22.4
62.9–85.4	21.0	21.3	17.2	18.8
>85.4	21.1	20.1	19.2	17.5
No data*	20.6	15.3	21.0	19.1
Meat (servings/week)				
<5.6	19.9	22.2	20.0	18.8
5.6–8.2	18.8	22.5	22.7	19.7
8.3–12.1	19.9	21.3	17.7	21.9
>12.1	20.8	18.9	18.7	20.5
No data*	20.6	15.3	21.0	19.1
Total beverages (liters/day)				
<2.0	30.6	23.7	22.2	9.2
2.0–2.5	26.6	31.9	22.2	17.0
2.6–3.3	23.1	26.1	30.5	23.5
>3.3	19.7	18.2	25.2	50.3
Chlorinated surface water (years)				
None	67.2	64.7	61.6	58.2
<19	19.9	23.3	21.4	29.1
19–39	6.5	6.6	8.2	6.4
40–59	3.9	4.5	6.0	4.4
>59	2.5	0.9	2.7	1.9
Coffee (cups/day)				
None	13.3	9.9	12.0	16.9
<2.1	18.2	23.1	27.4	24.7
2.1–3.8	19.4	25.8	20.2	16.9
3.9–5.9	22.8	25.5	23.9	21.7
>5.9	26.3	15.6	16.5	19.7

* Completed the short form (no food frequency questionnaire) or did not accurately complete the food frequency questionnaire.

tea, 17.3 percent and 13.4 percent were current smokers, respectively.

After adjustment for age and sex, there was no clear association between tea use and bladder cancer risk. The age- and sex-adjusted odds ratios (ORs) (95 percent confidence intervals (CI)) referent to nonusers were 0.9 (0.7, 1.1) for <1.0 cup/day, 1.0 (0.8, 1.2) for 1.0–2.6 cups/day, and 0.9 (0.7, 1.1) for >2.6 cups/day (table 2). Adjustment for age, education, smoking, family history of bladder cancer, high risk occupation, exposure to chlorinated surface water, total beverage intake, and vegetable and coffee consumption did not alter these findings. The analysis was also performed excluding proxy subjects and the results were unchanged (not shown).

To evaluate whether very high tea use was associated with bladder cancer risk, we conducted a post-hoc analysis using cutpoints at the 50th (3 cups/day) and 90th (5 cups/day) percentiles of consumption among the controls. The age and sex adjusted odds ratios (95 percent CIs) referent to nonusers were 0.9 (0.1, 1.1) for <3 cups/day, 1.0 (0.8, 1.3) for 3–5 cups/day, and 0.7 (0.5, 1.0) for >5 cups/day (*p* for trend = 0.2). Further adjustment for the same factors as above did not change the suggestive inverse association at the highest level of tea consumption (OR = 0.7; 95 percent CI 0.5, 1.0).

We next evaluated the interaction of tea consumption with smoking (ever, former, current), years of drinking chlorinated surface water (<20 years, ≥20 years), coffee consumption (no, yes), and total beverage consumption (median split). We observed a statistically significant inverse association between tea use and bladder cancer risk for those who reported lower (<2.6 liters/day) but not higher beverage intake (table 3), which persisted after multivariate adjustment, although the trend test was no longer statistically sig-

nificant. Results further stratified by sex showed no material difference (not shown). There were no interactions with the other variables evaluated (not shown).

After adjustment for age and sex, there was no clear association between tea use and kidney cancer risk (table 2). The age- and sex-adjusted odds ratios (95 percent CIs) referent to nonusers were 1.1 (0.8, 1.5) for <1.0 cup/day, 0.9 (0.7, 1.3) for 1.0–2.0 cups/day, and 0.9 (0.7, 1.3) for >2.6 cups/day (table 3). Adjustment for age, education, smoking, family history of kidney cancer, hypertension, body mass index, and dietary factors (fruit, vegetables, meat, fat, coffee) did not alter these findings. The analysis was also performed excluding proxy subjects, and the association was not altered (results not presented). In the post-hoc analysis using cutpoints at the 50th and 90th percentiles, there was a pattern similar to that seen for bladder cancer. Specifically, the age- and sex-adjusted odds ratios (95 percent CIs) compared with non-users of tea were 1.0 (0.8, 1.3) for persons who consumed <3 cups/day, and 1.0 (0.7, 1.5) for persons who consumed 3–5 cups/day, showing no association with kidney cancer risk. By contrast, the age- and sex-adjusted odds ratio (95 percent CI) was 0.7 (0.4, 1.3) among persons who consumed >5 cups/day, indicating an inverse association (not significant). Multivariate adjustment (same factors as above) did not alter these results. We also evaluated the interaction of tea consumption with smoking (ever, former, current), years of drinking chlorinated surface water (<20 years, ≥20 years), coffee consumption (no, yes), and total beverage consumption (median split); no interactions were found (not shown).

To provide a more direct comparison with data from the Iowa Women's Health Study, we used cutpoints similar to Zheng et al. (6). Compared with women who drank tea never or monthly, the age-adjusted odds ratios (95 percent CIs) were 1.3 (0.9, 2.0) for women

TABLE 2. Odds ratios (OR) and 95% confidence intervals (CI) for bladder and kidney cancer according to level of tea consumption, Iowa, 1986–1989

Cancer site	Tea consumption (cups/day)				<i>p</i> for trend
	None	<1	1–2.6	>2.6	
Bladder cancer					
Cases/controls	818/1,297	177/334	241/401	192/361	
OR, age, sex model (95% CI)	1.0	0.9 (0.7, 1.1)	1.0 (0.8, 1.2)	0.9 (0.7, 1.1)	0.3
OR, full model* (95% CI)	1.0	0.9 (0.7, 1.1)	1.1 (0.9, 1.3)	0.9 (0.7, 1.1)	0.5
Kidney cancer					
Cases/controls	212/1,297	62/334	58/401	56/361	
OR, age, sex model (95% CI)	1.0	1.1 (0.8, 1.5)	0.9 (0.7, 1.3)	0.9 (0.7, 1.3)	0.5
OR, full model† (95% CI)	1.0	1.2 (0.8, 1.8)	1.0 (0.7, 1.5)	1.1 (0.7, 1.6)	0.7

* Adjusted for age (continuous), sex, education (<high school, high school, >high school), smoking (never, former, current), pack-years of smoking (continuous), family history of bladder cancer, high risk occupation, total beverage consumption, years of chlorinated surface water, vegetable and coffee consumption.

† Adjusted for age (continuous), education (<high school, high school, >high school), smoking (never, former, current), pack-years of smoking (continuous), family history of kidney cancer, hypertension, body mass (continuous), and dietary factors (intake of fruits, vegetables, meat, fat, coffee).

TABLE 3. Odds ratios (OR) and 95% confidence intervals (CI) for bladder by level of tea consumption stratified by total daily fluid intake, Iowa, 1986–1989

Total fluid intake	Tea consumption (cups/day)				<i>p</i> for trend
	None	<1	1–2.6	>2.6	
High (≥2.6 liters/day)					
Cases/controls	396/553	81/146	150/223	166/265	
OR, age, sex model (95% CI)	1.0	0.8 (0.6, 1.1)	1.0 (0.8, 1.3)	0.9 (0.7, 1.2)	0.6
OR, full model* (95% CI)	1.0	0.9 (0.6, 1.2)	1.1 (0.8, 1.4)	1.0 (0.8, 1.3)	0.8
Low (<2.6 liters/day)					
Cases/controls	400/727	86/183	86/174	23/93	
OR, age, sex model (95% CI)	1.0	0.9 (0.7, 1.2)	0.9 (0.7, 1.3)	0.5 (0.3, 0.8)	0.02
OR, full model* (95% CI)	1.0	0.9 (0.6, 1.2)	1.1 (0.8, 1.5)	0.5 (0.3, 0.9)	0.21

* Adjusted for age (continuous), education (<high school, high school, >high school), smoking (never, former, current), pack-years of smoking (continuous), family history of bladder cancer, high risk occupation, total beverage consumption, years of chlorinated surface water, vegetable and coffee consumption.

who drank tea weekly, 0.8 (0.5, 1.2) for those who drank a cup of tea per day, and 1.0 (0.8, 1.4) for those who drank two or more cups per day, and thus these women who drank tea were not at altered risk of bladder cancer. For kidney cancer, the age-adjusted odds ratios (95 percent CIs) were 1.8 (1.1, 3.0) for weekly use, 1.0 (0.5, 1.8) for a cup per day, and 0.7 (0.5, 1.2) for two or more cups per day.

DISCUSSION

The overall results of this population-based case-control study do not support a strong protective effect of tea consumption for bladder or kidney cancer. In post-hoc analyses, using higher cutpoints, there was a suggestive inverse association at the highest level of use, but no evidence for a dose-response relation. For bladder cancer only, there was an inverse association with tea consumption among subjects below the median for total beverage intake.

The findings of a weak inverse or no association of tea with bladder or kidney cancers are consistent with the results of most other studies (8–10, 14–17, 20, 22–26). We could not confirm the findings from the Iowa Women's Health Study (6), where an inverse association for increasing tea drinking and cancers of the urinary tract (bladder or kidney) among older women was reported. In that study, compared with women who never or occasionally drank tea, the relative risks (95 percent CIs) were 1.06 (0.72, 1.57) for women who drank tea weekly, 0.65 (0.31, 1.35) for women who drank one cup of tea per day, and 0.40 (0.16, 0.98) for women who drank two or more cups of tea per day (*p* for trend = 0.02) (6). When we used these same cutpoints for these women, we found no evidence of an association. In the Iowa Women's Health Study, the authors reported that only 8.6 percent of the women reported drinking two or more cups of tea

per day. In another population-based case-control study in Minnesota, 9.7 percent of female controls reported drinking two or more cups of tea (28). Tea consumption in our study was higher than that reported by these other studies conducted in the Midwest, with 16 percent of males and 20 percent of females in our study reporting that they consumed two or more cups of any tea per day. The inclusion of iced tea in our measure of tea consumption likely accounts for this discrepancy. In the study reported by Zheng et al. (6) women were asked about average use of "tea, not herbal tea" in the last year using a food frequency questionnaire, and may have underreported iced tea use. The frequency of consumption of more than two cups of hot tea per day in our study was only 6 percent among women and 4 percent among men, which is comparable with these other studies. However, there was no association between hot tea per se and risk of bladder or kidney cancer in our data even when we used the cutpoints of Zheng et al. (6) (not shown).

A limitation of the present study is that we could not distinguish green versus black tea use, and we included herbal tea in our definition of tea use. However, during the time period when this study was conducted in Iowa, the predominant type of tea used would be expected to be black tea (1, 2, 36).

An interesting modification of effect in our study was observed when tea consumption was stratified by level of total fluid intake for bladder cancer, such that tea consumption was protective but only for those below the median for total fluid intake and with high levels of tea intake. The median level of total beverage consumption in this study was 2.6 liters/day, which is consistent with prior studies (12, 14, 17, 18). Total beverage intake was positively associated with bladder cancer risk in this study, consistent with most (12, 17, 18, 35, 37–39) but not all studies (14, 40, 41). Odds ratios (95 percent CIs) compared with persons who

drank <2.0 liters/day (lowest quartile) were 1.3 (1.0, 1.6) for persons who consumed 2.0–2.5 liters/day, 1.4 (1.1, 1.7) for those who consumed 2.6–3.3 liters/day, and 1.4 (1.1, 1.7) for those who consumed >3.3 liters/day, and these persons were at elevated bladder cancer risk after multivariate adjustment for the factors in table 2 (including tea). Total fluid has been hypothesized to increase the risk of bladder cancer by increasing the workload of the bladder or by exposing the bladder to specific fluids that contain carcinogens or chemopreventive agents (14). While the former mechanism is supported by the overall effect of total fluid on bladder cancer risk, the latter mechanism has some support from findings that coffee and alcohol may increase risk and consumption of milk may decrease risk (14). However, these hypotheses are not necessarily mutually exclusive, and one possible explanation for our finding is that at lower levels of fluid intake, the carcinogen/anti-carcinogen mechanism predominates, while at higher levels the excess workload mechanism is most relevant. To our knowledge, no prior study has assessed the interaction of total beverage and tea consumption, and while it is interesting, the role of chance in our finding cannot be excluded.

Both black tea and green tea extracts have been shown to inhibit tumorigenesis in animal models, and appear to work through several possible mechanisms including inhibition of nitrosation reactions, modulation of phase I (P-450 type) and phase II enzymes, and action as an antioxidant and free radical scavenger (1–3). Most of the focus has been on catechins, such as (–)-epigallocatechin-gallate (EGCG), as active agents in tea. Catechins are found in highest quantity in green tea, and are oxidized to theaflavins and thearubigins during the manufacture of black tea (1, 2). A recent study (5) also suggests that catechins such as EGCG may be metabolized by the body to final substances similar to those found in black tea.

The strengths of this study are that it is a large, population-based case-control study and has a high response rate for both cases and controls, which makes selection bias unlikely. There was a relatively small number of proxy respondents (higher for kidney cancer), and analyses with and without proxy respondents did not differ, which also makes bias unlikely. Differential recall bias between cases and controls is always a possibility, but the hypothesis about tea and cancer was not well known in the late 1980s and a standardized questionnaire was used. Non-differential recall of tea use would be expected to attenuate any association. Finally, tea use was fully captured by specifically inquiring about both hot and iced tea use. However, we did not have details on use of green, black and herbal tea specifically, although the majority

of use would be expected to be black tea in this population during the late 1980s (1, 2).

In conclusion, our study offers minimal support for an inverse association between tea consumption and bladder or kidney cancer risk, although high levels may afford a protective effect. The inverse association between tea and bladder cancer among persons with lower total fluid intake is intriguing and requires confirmation.

ACKNOWLEDGMENTS

Supported by National Cancer Institute contracts NCI-NO1-CP-51026 and NCI-NO1-CP-85614. Dr. Cerhan was supported in part by a National Cancer Institute Preventive Oncology Academic Award (K07 CA64220).

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